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water on this principle, extending to nearly a mile in length, is estimated at 297,800*l.*

No. VIII.

THE PROGRESS AND PRESENT STATE OF THE DAGUERREOTYPE ART.

By M. Claudet.

The discovery of a new art founded upon some startling facts in science, however perfect it may appear at the beginning, and little subject to improvement, rarely remains long stationary; and still more rarely can we foresee all its useful applications.

As this observation applies particularly to the ingenious and curious discovery of Daguerre, it may be interesting at the present moment to examine the progress it has made during the last four years, and to determine its present state, in order that we may be able to compare, at given periods, the various stages of improvement through which photography has passed.

The daguerreotype has opened two extensive fields of inquiry: the one, for the investigation of facts, by which the sciences are to enrich themselves, and by which some of the phenomena of the laws of nature may be explained; the other for the advantage of society, in reference to the creation of a new branch of manufacture, and to a new art, which are destined to give employment to many persons; to which may be added the improvements that the daguerreotype will introduce in the fine arts.

It has been remarked that the discovery of photography was as great a step in the fine arts as that of the steam-engine in the mechanical arts. There is no exaggeration in this observation; and certainly our age (which is the era, not of wars and conquests, but of social improvements, of emulation in the arts, sciences, and manufactures), will be celebrated in future times for this extraordinary invention.

It is curious to observe how rapidly sometimes new discoveries are followed by other important discoveries, forming the links of a mysterious and infinite chain, one end of which approaches the great Creator of all things.

In the year 1811, Courtois discovered the chemical substance called Iodine, and, as late as 1826, Balard discovered Bromine; these two elements are the only substances which in the daguerreotype form with the silver a compound sufficiently sensitive to the rays of light, and without which substances the daguerreotype could not have existed. Such is the progress of science, that there is no fact, however insignificant it may appear at first, which does not aid the advancement of philosophy, and the improvement of mankind.

When these new elements were first discovered, how little was it thought that they would so soon become the source of the magic invention of the daguerreotype, which again will undoubtedly lead to other discoveries, perhaps far more important than itself!

There are some persons who, although admiring the daguerreotype in its effects, perceive nothing beyond the mere spontaneous, although beautiful, reproduction of objects,—the representation of a building or a landscape in their minutest detail, and in the portraying of human features: but this is only the useful and immediate application of the art in its state of infancy; its destinies are of a much higher order.

It may be said that already optical science has been much benefitted by it. Never before has it been found so necessary to construct object-glasses with the shortest possible focus, without increasing their aberration; this has now been done, and we have double achromatic object-glasses refracting a perfectly well-defined image upon a screen of seven inches in diameter, although the focal length is not more than eight or nine inches: this improvement in the object-glasses of the camera obscura being also applicable to the construction of telescopes, will enable opticians to make powerful instruments of a considerably smaller bulk.

The science of optics, the study of which was confined almost exclusively to professional opticians and astronomers, is now in the hands of a thousand operators in photography, who are constantly studying and endeavouring to correct the imperfections of their apparatus; and their researches and investigations will, no doubt, ultimately lead to many useful discoveries.

In passing from the practical part of optics to that which is purely theoretical, that which treats of the various rays emanating from the sun, of their laws and properties, and of the principles and phenomena of light, considered as a whole, or a compound of various kinds of matter (if I may be allowed the expression), as being produced by emission or by undulation; if these interesting points are ever better explained and understood than they are at present, it appears highly probable that the daguerreotype will be the instrument leading to these results: at least it is certain that, in experiments and researches upon this subject, philosophers will be greatly assisted by the innumerable facts collected in the daguerreotype operation.

The existence of invisible or chemical rays is proved by the various processes of photography; for, in speaking of the daguerreotype, we cannot omit to mention the beautiful discovery of Mr. Talbot, which he has called the Calotype. Neither must we omit the curious discoveries of Sir John Herschel, forming another step in photography, which is called by that learned astronomer Crysotype.

The experiments made in these various photographic processes all agree in the fact, that the rays which produce a change upon the sensitive screen are not the rays of light, but other rays travelling with light, and emanating from the same source, which are sometimes more refrangible than the violet rays, and less refrangible than the red rays under other circumstances; by which it would appear that there exist chemical rays on each extremity of the spectrum: but many facts seem to prove that there is also another kind of ray, which is refracted to all parts of the spectrum according to the dispersive power of the lens, and following certain laws of refraction which are different to the laws regulating the other rays; so that different kinds of glasses may have the same power of dispersion for the apparent rays, and be endowed with different dispersive powers for the invisible photographic rays.

I am not prepared to develope the facts by which I have aimed at this conclusion, because my experiments are not yet complete enough to furnish a sufficiently plausible and satisfactory explanation of this phenomenon.

From the application of the daguerreotype to the advancement of practical and theoretical optical science, let us consider how this art is likely to benefit chemistry.

In this respect, is it not sufficient to call to mind that some of the elements we have alluded to, viz. iodine and bromine, have been very little investigated by chemists, and that all their properties are not yet known, neither have the whole of their compounds been ascertained?

Now that they are so much employed by every photographer, and their effects minutely studied, is it not reasonable to expect that in the hands of the chemist, also, the daguerreotype may become the medium of scientific research?

After having enumerated the advantages which several branches of science have already derived from the daguerreotype, and having hinted at those which they are still likely to derive from new investigations arising out of the same subject, we shall now refer to its connexion with the fine arts.

There is a singular anomaly in the history of the progress of human discoveries. They frequently seem to follow each other in an inverted order, and very often the ingenuity and perseverance of man, through immense labour and research, have produced works which previously existed in nature, and which, had nature been first studied, would have been executed in much greater perfection, with the saving of an immensity of trouble.

After ages of civilisation, it is only within the last two centuries that Battista Porta, being in a dark room, observed that an inverted image of outward objects was represented on the wall, opposite to a small hole in the window-shutter; to the hole he applied a convex lens, and then, instead of a diffused and indistinct image, he was able to obtain a well-defined and clear picture.

This accidental discovery was the origin of the camera obscura. Yet in nature such instruments have existed since the creation of man, for the eye is nothing more than a perfect camera obscura.

If philosophers had only turned their attention to the construction of the human eye, if they had been able to examine its beautiful arrangements, the camera obscura would have been discovered at a much earlier period. The same observation applies to the discovery of galvanic electricity, and the apparatus by which this principle is developed. There exists in nature the most perfect and complete galvanic battery; and if philosophers had been able to examine the *Gymnotus electricus*, or electrical eel, it would not have been left to chance and ingenuity to discover one of the most splendid phenomena in the circle of science.

In all cases we find, that whatever we at first consider as a new invention existed before in nature: therefore, man invents nothing, he merely discovers that which has long before been produced by the hand of the Creator; and, as Bacon asserts, " man is only the interpreter of nature."

By the judicious combination of black lines or black dots upon white paper, or white lines and white dots on black paper, artists have been able to represent all objects visible to the eye; the effect is complete and identical.

The laws of perspective are well understood by this simple means.

We thought that such a work was quite artificial, a calculated imitation of nature which was not true, but that we learned, as it were, to read by habit. We thought that a child could no more understand a picture than read a book. But here again art has been invented, and it is only lately that we have found that nature operated exactly as art, and produced the very same effects.

The daguerreotype represents the objects which we see by the same rules, by the very same means, and proves that the objects cannot be represented otherwise than as the painters had represented them before.

If the daguerreotype had been invented before the art of painting, then we should have never doubted its accuracy, and we should not have thought that we were deceived or taken by delusion.

The daguerreotype plate is etched in by nature, exactly (although in a more perfect manner) as is the plate of copper or of steel by the ingenuity of the engraver.

When we submit a daguerreotype plate to the magnifying power of the microscope, we observe upon its surface an infinite number of small white dots, which are more or less close to each other, according to the predominance of light or shadow in the picture. In fact, the magnified surface of the plate has the appearance of the sky on a bright night; the white parts present an agglomeration of bright dots, similar to the milky way seen through a telescope, which to the eye appears as a white drapery or belt thrown across the sky.

It would not, therefore, have been surprising if the arts of drawing and painting had been the consequence of the daguerreotype; but it is really wonderful that, without the help and the labours of the daguerreian process, drawing and painting should have attained the perfection so conspicuous in the works of the great masters. Indeed that single fact proves, more than any thing else, the greatness of their genius.

However, it was only given to a very few to grasp nature, but henceforward young artists, of less genius, will be able, by studying the effects of the daguerreotype, to produce works of great merit.

We may also assert that the great masters would have been still more perfect in their imitations of nature if the daguerreotype had been known to them. When Paul Delaroche, the celebrated painter, was asked his opinion of the invention of Daguerre, he unhesitatingly declared that " the process of M. Daguerre had given to art many conditions so essential to its perfection, that they would become, even to the most skilful artists, subjects of observation and study;" and, further, that "this admirable discovery was an immense service rendered to the fine arts."

Is it, then, surprising that the announcement of the discovery of Daguerre created among philosophers and enlightened men so great an interest? that it was received with such amazement and admiration? Is it surprising that the government of a great nation should have proposed to its parliament to award to the discoverer a national recompense?

Two centuries ago the daguerreotype art would have been looked upon as the work of witchcraft, but in our age of improvement we are accustomed to extraordinary discoveries; we are capable of admiring and appreciating these huge efforts of genius, and nothing surprises us. The steam-engine, that perfect machine so well organised (which, as an animal, requires only to be fed to work by itself, and to produce continuous motion), has been created almost in our own time and under our own observation.

After such a triumph of the genius of man and of modern science, we see no limit to human discovery; and, indeed, we might believe that the word *impossible* should be erased from language.

The year 1839 gave birth to two discoveries, which, from the similarity of their properties and results, may, with propriety, be called sister arts. These are the daguerreotype and the electrotype, both of which reproduce and multiply in the greatest perfection; the one acting under the influence of light, the other under the influence of electricity; these two mysterious agents seem, in fact, to constitute the soul of nature.

In the case of the daguerreotype light draws—in that of the electrotype electricity models; and although their work seems, at first sight, to have no connexion, still the two act in unison. The daguerreotype image may be repeated to any extent by precipitating metal upon it by the action of electricity, producing another plate upon which the original is imprinted in its various tints; in fact, the two images are so identical in their effect, that it would be impossible, without knowing previously of what metal they were respectively composed, to decide which was the original and which the copy. This curious phenomenon may assist in explaining the nature of the formation of the daguerreotype image; it proves, undoubtedly, that the light and the mercury acting together upon the iodide of silver, alters the arrangement of the molecules of the surface, so that minute crystals are produced, which, like cut diamonds, present in almost every direction a favourable angle of reflection to the eye, from which cause they assume a white appearance; the electrotype surface, moulded upon these crystals, receives exactly their counterpart, and the two surfaces are to each other as the relief is to the matrix which has produced it; so that parallel faces having the same angle of reflection for the eye, corresponding parts of the image present identically the same effect; and this curious reproduction of the electrotype illustrates better than any other effect the great perfection of these metallic deposits, and also the infinite minuteness of the particles of metal reduced by the galvanic agency.

The original process of Daguerre consisted in submitting a polished plate of silver to the vapour of iodine, until by the chemical combination of the two a compound was found exquisitely sensitive to the influence of light, so that when the image at the focus of a camera obscura was thrown upon a plate thus prepared, the design was invisible, though certainly impressed; and this latent image was afterwards brought out by the action of the vapour of mercury. This was his process in all its simplicity; and it seemed at first to be but little susceptible of improvement; in fact there appeared to be scarcely any room for alteration, at least to advantage. Nevertheless, the manipulation recommended by Daguerre has been greatly simplified, and rendered more effective; although, strictly speaking, the invention has remained the same, the changes consisting chiefly in modifications of the original operations.

It is always a surface of silver, coated with iodine, exposed to the influence of light in the camera obscura, and then submitted to the vapour of mercury for the purpose of bringing out the image, after which it is immersed in a solution of hyposulphate of soda, to remove by solution all traces of the iodine from its surface. Up to the present time it has never been found possible to alter materially any of these fundamental principles.

The improvements introduced have been chiefly in the instruments employed, and in some additions to the chemical part of the operation; by the first means greater artistic effect has been given to these pictures, they have been rendered more forcible and defined in detail; and, by the last-named improvement, the plates have been made much more sensitive to light, so that the time of the operation has been amazingly diminished. With the original process it was considered impossible to apply the daguerreotype to the production of portraits; for, with the iodine alone, and the long-focused camera obscura which was at first employed, no picture could be taken, even under favourable circumstances, in less than about a quarter of an hour; and as the correctness of a portrait produced by this art depends upon perfect immobility during the whole of the sitting, the mere idea of such an application of photography was looked upon as altogether absurd.

But the fact that an image could be obtained in a quarter of an hour, gave the hope that, by improving either the optical arrangements of the camera, or the chemical preparation of the plate, means could be devised to arrive at the grand desideratum, viz. the application of the daguerreotype to portraiture.

It was, however, soon found that, by constructing object-glasses having a shorter focus, the operation could be reduced nearly in proportion to the reduction of the length of the focus, so that, by applying to the camera an object-glass of three inches' focus instead of twelve, the operation was four times shorter, or reduced to about four minutes.

From that moment portraits were taken by the daguerreotype; but still few persons could remain in perfect quiescence during such a length of time, and, if they were able to do so, it was only by submitting themselves to a painful constraint, which unavoidably gave to the countenance a most unpleasant expression. Nevertheless this was a step which encouraged the idea of further improvements; and about this time an ingenious optician of New York, Mr. Woolcott, thought of substituting for the refracting glasses a concave mirror of such an aperture, that a greater amount of light from the object might be concentrated at its focus, where he placed the sensitive plate. By this means he could operate much more quickly than by a refracting apparatus, and thus reduce the time of sitting.

This was another interesting step in the improvement of the art, but such a process was subject to many difficulties and defects, which rendered it inferior to the refracting apparatus. If the mirror was made of metal, it was subject to corrosion, by being constantly exposed to the changes of the atmosphere ; if it was of glass, then two images of different focus were formed; the one from the silvered surface, and the other from the surface of the glass, so that a sharp and well-defined image could not be produced. Another material defect, however, of this process was that by necessity, in placing the plate between the object and the mirror it was absolutely necessary to operate upon a very small size, or else the plate would have screened the greater part of the aperture, and the advantage of the increased reflecting area would be lost. Besides the rays producing the best definition and the most correct image are reflected from the centre of the mirror, and are precisely those which are lost by the unavoidable position of the plate.

Nevertheless, the invention of Mr. Woolcott was at the time a great improvement, and deserves to be recorded in the history of the daguerreotype as a very clever and very ingenious arrangement. The effect of the daguerreotype picture is formed by a very slight film similar to the bloom of the grape or the down of the wing of the butterfly, so delicate that it may be wiped off or destroyed by the slightest touch. This fragility induced many persons to endeavour to discover some method of fixing the design. Mr. Dumas, the celebrated chemist, discovered a vegetable varnish which, dissolved in boiling water, could easily be applied to the surface of the picture, and, when dried, was a perfect protection to the image. But it was left to Mr. Fizeau to discover what has proved one of the greatest improvements in the daguerreotype process, and which consists in fixing the delicate image by means of a transparent coating of gold, applied by boiling upon the plate a solution of chloride of gold, which not only renders the image more durable, but has the advantage of increasing the tint, so that a picture fixed by Mr. Fizeau's process is rendered more forcible, and the mirror-like effect is almost destroyed. Some time after Mr. Fizeau had made his discovery, I was fortunate enough to devise a means of increasing the sensitiveness of the prepared tablets. This I accomplished by exposing it, previously coated with iodine, to the vapour of a compound of chlorine and iodine, or chlorine and bromine, which second exposure so modified the chemical coating of the plate, that its sensitiveness was increased to at least fifty or sixty times, and from that moment it became possible to take portraits without difficulty with the ordinary apparatus.

With iodine alone, and a camera furnished with an achromatic object-glass of the shortest focus, it required about five minutes, though, by the simple addition of the vapour of chloride of iodine, I at once attained the power of operating in as many seconds, and under the most favourable circumstances, in much shorter time; for it has been found possible to reproduce moving objects.

In one word, the operation has (by the introduction of this improvement) been literally instantaneous.

Daguerre recommended that the plate should be exposed to the mercury at an angle of forty-five degrees, supposing that the vapour received upon it at that inclination would cause the developement of the picture with greater effect. But this operation is equally effective and rapid in any other position, and I have not only succeeded in producing the image in a vertical or horizontal position, but, even when the coppered side of the plate was turned downwards or towards the mercury, I have found the effect to be precisely the same in all these various positions.

I have also ascertained that the mercurial vapour does not enter into combination with the surface of the plate, unless it has previously been exposed to the influence of light. A plate was exposed to the mercury before and after it had been coated with iodine, but the operation in the camera was not affected by this premature exposition to the mercury, so that it is absolutely necessary that the mysterious influence of the light should be exerted upon the plate before any degree of affinity exists between it and the vapour of mercury with which it is brought in contact.

The knowledge of this fact led me to a curious modification of the process of Daguerre.

Having ascertained that the mercury did not injure the sensitiveness of the plate (before exposure to the light), it occurred to me that it would be possible to conduct simultaneously the operations of the camera and the mercury-box, which I did by placing in the camera a cup containing mercury previously heated by a spirit-lamp.

The plate was thus constantly immersed in the mercurial vapour during the exposure to the image of the camera.

As soon as the light had begun to operate, the vapour of mercury was combining with the iodine of silver, and, by means of a light striking through a piece of yellow glass, I was able to study the progress of the operation. For it is a curious fact, as I shall endeavour to shew presently, that yellow, green, and red rays of light scarcely produced any effect upon the prepared plate of the daguerreotype; and it is still more extraordinary that yellow light operates upon the plate in a manner perfectly analogous to that of mercury in the developement of the invisibly impressed image, so that the light admitted into the camera obscura, so far from injuring the operation, was accelerating the developement of the image. This effect of the yellow rays was first noticed by Mr. Bequerel, and, from this property, he has called them "continuating rays." Some photogenic paper had been exposed to light in a camera, and was afterwards submitted to the action of yellow rays by being covered with a piece of glass of that colour, and the image was soon made apparent by the specific action of the above-mentioned rays. Some time after, Mr. Gaudin repeated the same experiment upon a daguerreotype plate, and he also succeeded in producing the image by yellow light without any exposure to the action of the mercury. The effect produced by these two processes are so analogous, that it would be difficult, perhaps impossible, to decide which had been produced by mercury and which by yellow light. If the yellow rays perform in the developement of the image the same action as the vapour of mercury, how are we to account for the effect? Yellow rays produce upon the plate those white microscopic dots or crystals which were assigned to the combination of mercury; but it is supposed that yellow rays cannot form a compound, that they can only modify the arrangements of the molecules of the surface, and produce a sort of crystallisation. And why should not mercury, by some electrical property, occasion a similar modification or crystallisation without itself combining chemically with the plate. Already Dr. Moser, in his beautiful researches, has offered a theory upon the formation of the image by the vapours of mercury, in stating that these vapours develope latent yellow light, and that it is only as continuating yellow rays that the mercury brings out the image.

But it is more probable that the whole effect of the daguerreotype image is due to some electrical influence of light, and that mercury and yellow rays produce a like state of electricity.

Daguerre also recommended that we should raise the vapours of mercury by means of a spirit lamp, which heated the metal to a temperature of 165°, from which it was to cool gradually to 120°. But I have found that the temperature is quite immaterial, provided it is not raised to a degree which would cause sublimation. It has been ascertained that mercury evaporates at all temperatures above its freezing point, and those vapours are at all times sufficient to bring out the daguerreotype image. The only difference is the length of time required for the operation, this depending of course upon greater or less developement of vapours. I have found that during the month of December, at a temperature of 45°, the image was brought out in two hours without heating the mercury, and I have been able, at the same temperature, to cause the developement of the image in ten minutes, by placing the plate in the vacuum of an air-pump containing a small quantity of mercury.

I consider that the daguerreotype image is begun and finished by some electrical influence of light, that all the coloured rays, as we have before mentioned, carry with them invisible rays which operate upon the plate, that the largest quantity of these accompany the blue rays, a lesser quantity the yellow, and a still less quantity the red. Thus the yellow ray is not entirely destitute of chemical power, although it operates very slightly upon the parts which have received the strong effect from the rays accompanying the blue, and, though enough to continue the effect begun, it is not enough to bite upon the parts not already affected. So that the operation begun by the invisible rays through the blue medium is completed by the small quantity of chemical rays accompanying the yellow light.

Without being able to decide which of the various kinds of rays emanating from the sun are those producing the photogenic effect, it is a well-known fact that they travel with all the rays of the spectrum, but that by far the largest proportion have a degree of refrangibility nearly agreeing with that of the blue rays, that the portion found with the yellow is considerably less, and still smaller with the red. In interposing a blue glass between the object and the image, the effect is nearly as great as if there was no medium ; by the interposition of yellow glass the effect is considerably reduced, and almost totally impeded by red glass.

The great number of elements acting in the daguerreotype process, the ignorance in which we are concerning all their properties, the influence of various unknown causes, which undoubtedly perform a part in the operation, render the process very difficult and uncertain. So many conditions are requisite to a successful operation, that, indeed, it might be said that failure is the rule, and success the exception. This renders the task most delicate and arduous. The operator has constantly to overcome new difficulties, and the greatest is, perhaps, the want of power to appreciate the amount of operating rays existing at every moment. No photometer can be constructed ; for the acting rays are not always in the same ratio to the intensity of light. It is true that, if it were possible to measure the comparative quantity of blue, yellow, and red lights, at all times, then it would be of considerable assistance in judging of the amount of photogenic light. But even this test would not be sufficient, for the acting rays are not strictly identical with the blue rays. Still to be able to ascertain that there were no yellow or red vapours in the atmosphere, making, as it were, screens of those colours between the sun and the object, would be, no doubt, an important assistance.

It is to the influence of these vapours that the difference found by operators in various climates is due, which difference seemed at first irrational, but which can now easily be explained.

When the daguerreotype was first discovered, it was expected that southern climates would be more favourable than northern for the process, and that, in countries where the sun constantly shines, the operation would be considerably shorter. This has not been proved to be the fact, and the following reason may be given for such an apparent anomaly. Light is more intense in the northern latitudes up to a certain degree, on account of its being reflected in all directions by the clouds disseminated in the atmosphere; whilst in the drier climates the open sky, instead of reflecting light, absorbs a great quantity of it. Of course, in speaking of clouds, it cannot be meant that a completely covered sky is more favourable than a sky without any clouds, for in this case the sun is entirely obscured. But still there are days when, although the disk of the sun is not seen from any part of the horizon, the thin clouds allow a much more considerable quantity of photogenic rays to be diffused and retained in the lower strata of the atmosphere than when there are no clouds, and that by some imperceptible vapours the light has a yellow or red tint.

There is a curious fact which would seem to corroborate the argument in favour of greater intensity of light in northern climates. It is known that, by a provision of nature, all races of men are constitutionally adapted to the climates in which they are destined to live, that the inhabitants of the tropics can bear a much higher temperature than the inhabitants of the north. May it not be the same for light? The eyes of the inhabitants of the cloudy and snowy countries are adapted to bear a stronger light than those living in the south. In the course of my daguerreotype experience, I have observed that there is a comparatively greater number of Englishmen, than of Frenchmen, Spaniards, and Italians, capable of sitting for their portraits in a strong light, without being much incommoded. If this fact is correct, such a provision of nature would prove that generally light is more intense in the northern climates, and that it decreases gradually towards the equator.

It was at first expected that the climate of England, and countries similarly situated, would be unsuitable to the daguerreotype operation; nevertheless, it has turned out that this is one of the most favourable climates for the practice of the process. Putting out of the question the greatest part of the months of November and December, when the fog mixed with the smoke obstructs all light in London, I assert, from my own experience, that the climate of this metropolis is generally more propitious than that of Paris to photographic operations, for the representation of near objects, and for taking portraits. Of course, this observation does not apply to general views taken at a distance; for, in this case, although the light is photogenic, still the misty vapours which generally prevail in England are an obstacle to the formation of clear images. In such a case, the sensitive surface has quickly and fully been affected, but not in a clear and defined manner.

There is another curious fact connected with the photogenic operation, which is, that on the summits of high mountains the action of light upon the plate is not so intense as in the lower regions. A clever operator was sent two years ago from Paris into Italy to take daguerreotype views of the most interesting spots of that country. After having visited Rome, Florence, Naples, Venice, and other towns, and succeeded in producing a beautiful and curious collection, he wished, in crossing the Alps on his journey home, to obtain some views of the glaciers, and other Alpine scenes; but, what was his surprise in finding that he could not obtain in one hour, and one hour and a half, in full sunshine, an image of these snowy mountains, having the same degree of force and distinctness as views which he had produced in less than fifteen minutes in the lower countries which he had just visited. The skill of this operator was great; he tried several times, and always with the same difficulty, and at length he abandoned the idea of bringing with him a perfect specimen.

The cause of this fact may be ascribed to the reason given before, that a sky without clouds absorbs a great quantity of light, and that upon high mountains the rarity of the atmosphere would occasion a certain loss of light. But it remains to be ascertained to what degree the light is absorbed, or otherwise affected by the variation in the density of the air at great elevation above the surface of the earth.

Before concluding, I must speak of a very important improvement lately applied to the daguerreotype art, which has not as yet been published. I allude to a new process by which the daguerreotype plate may be engraved by a chemical operation, and formed into a metallic plate, from which may be printed an unlimited number of copies.

Since the discovery of the daguerreotype, the attention of many ingenious persons has been turned to this interesting subject; Mr. Donné, in Paris, Dr. Berrès, at Vienna, and Professor Grove, in England, have all separately made several attempts. The first two gentlemen have not published an account of their processes; but they have produced specimens which shew that engraving by the daguerreotype is not altogether a desperate case.

The process of Professor Grove consists in dissolving by the electrotype process the parts of the picture which consist of pure silver: thus the plate is etched in, and transformed into an engraved plate for printing. This process is very ingenious, and creditable to the inventor;

but it appears that the action of the galvanic battery sometimes extends to those parts which should remain unattached.

Mr. Fizeau, to whom the daguerreotype is already indebted for one of its greatest improvements, viz. the fixing of the image, is the fortunate discoverer of this new mode of engraving by a chemical operation.

By his process an unlimited number of copies may be obtained without impairing the plate. This discovery seems to complete the art, and to render it really useful.

Now, sculpture, painting, architecture, models from life,—all the productions of the fine arts,—portraits, &c. will be reproduced in their reality, while works of literature and science will be illustrated, not by wood-cuts, not by artistic engraved steel or copper-plates, but by the exact copies of the daguerreotype image.

Although the daguerreotype has hardly been in existence four years, it already ranks as one of the most prominent inventions of the present day, leaving scarcely any thing to look for in the way of improvement. It is true that it remains to find the means of reproducing the natural colours of objects; but, although there seems no dream too marvellous in the progress of discovery, still the idea of fixing the colours of the object in the camera obscura is so little in accordance with the present state of science and with the properties of the known elements, that we must be satisfied with the process as it is.